Submarines Today: In Too Deep?

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EXECUTIVE SUMMARY

Title: Submarines Today: In Too Deep?

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Thesis: Can any lessons be learned from the effectiveness of submarines throughout history? Given today's geopolitical situation, would the U.S. Navy be better served with more or less emphasis on maintaining or improving its submarine force? Given the shifting strategic focus of the U.S. to the littoral regions of the world, is there a place for the submarines in the U.S. Navy?

Discussion: The history of submarine warfare in the U.S. is one of success. The Submarine Service has always rapidly and readily adapted to any new mission placed on them. This has never been more true than today.

Looking to the future, strategic planners determined that the next U.S. battles will be in the littoral regions of the world. Naval planners recognized this shift in focus and began developing weapons to fight there. One of those weapons is the submarine. Design improvements are being incorporated into the improved *Los Angeles* class, the *Seawolf*, and the NSSN. These improvements are designed to allow these ships to conduct littoral missions while maintaining the capability for the traditional ones.

The improved *Los Angeles*, the *Seawolf*, and the NSSN are well adapted to these new missions, but their costs will be the determining factor whether they will be effective. Only 3 $1.2 billion dollar *Seawolf*s are being built. To compensate for this, the Navy decided to develop the less expensive, but better suited NSSN and no other types.

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Conclusion: The U.S. Navy is at a critical decision point in its history. With budgets continuing to shrink, the Navymust decide whether to continue with its current mix of ships or select one type over another. The solution to this dilemma is to begin building relatively low cost diesel submarines. These diesels will incorporate all of the technologic advances of the NSSN and *Seawolf*, but will be designed using new computer technology and built in modules. The complementary nature of diesel and nuclear submarines will allow the U.S. to maximize their capabilities in both blue water and the littorals. The cost savings will allow for increased production runs, maintaining our industrial base.

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CHAPTER 1

INTRODUCTION

> The Cold War may be over, but the need for American leadership and commensurate military capability endures. Many of our most vital interests remain overseas where the Navy and Marine Corps are prepared for new challenges--*forward* deployed, *ready* for combat, and *engaged* to preserve the peace.[1]

The end of the Cold War, like the end of all wars in U.S. history, saw the shrinking of the defense budget and a corresponding downsizing of the services. After winning the Cold War, partially by outspending the Soviet Union in the arms race, many Americans concluded that the military's job was finished. Thus, the defense build-up begun in the Carter presidency and accelerated during the Reagan years, came to a crashing halt. The days of big budgets, expanding programs, and Secretary of Defence Weinberg's 600 ship Navy, are long gone. The much hoped for "Peace Dividend" translated into a much smaller defense structure. As a result of the Base Realignment and Closure process (BRAC), the bottom-up review, and now the Quadrennial Defense Review (QDR), the Armed Forces are contracting to post-World War II dimensions. The dissolution of the Soviet Union eliminated

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[1] U.S. Department of the Navy, "Forward...From The Sea," (Washington, DC: GPO, 1995), 10.

the single, clear threat that the United States used as the basis for its force planning assumptions.[2]

Unfortunately, this downsizing comes at a time when the U.S., as the only "Super Power," is required to be prepared to fight two nearly simultaneous major regional conflicts (MRC). At the same time, however, the U.S. Armed Forces are expected to maintain an overseas presence as a visible deterrent with less money, ships, and personnel. While the threat from the Soviet Union has diminished, the United States is left with a number of lesser, more ambiguous threats such as those in Bosnia, Haiti, Somalia, Albania, Rwanda, and Liberia.

Recently, Secretary of Defense, William S. Cohen, when asked when U.S. forces would be deployed, said, "...action would be taken to protect vital U.S. interests, in some cases where they are 'important' but not vital interest, and occasionally when American troops are needed in humanitarian operations."[3] So, in addition to their traditional missions, U.S. Forces must also conduct less traditional missions which include Military Operations Other Than War (MOOTW).

An example of this downsizing can be found in the U.S. Navy. From the height of the Cold War, the size of the Navy

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[2] LT Christopher P. Carlson, USNR, "How Many SSNs Do We Need?" *Proceedings* (July 1993): 49.

in personnel and ships has gone from 593,000 to 385,000 sailors and 580 to 346 ships. The price of this contraction is felt in longer and more frequent deployments. This effects not only readiness, but also retention. Navy submarines, developed to meet the Soviet threat, were determined to be expendable and no longer "vital" to the national defense. As such, they have experienced substantial downsizing. One program, the *Seawolf* (SSN-21), developed to counter the Soviet SSN threat, was particularly hard hit. Its production run was decreased from 29 submarines during the Reagan years to 3 today.

In order to retain a place in the national defense structure, the submarine service was forced to review its priorities and accept unorthodox missions. Fortunately, farsighted Naval Planners saw this reduction coming and began developing new submarines while improving existing platforms to make them capable of fulfilling these less traditional missions.

Submarines were first developed for their stealth, and the most valuable trait of today's submarines is still its stealth. They will remain the Navy's most deadly weapons until technology improves enough to make the oceans transparent. Submarines force an adversary to divert substantial planning and material resources to the complex,

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[3] Bill Gertz, "Cohen Pledges Troop Pullout in Bosnia," *Washington*

expensive business of anti-submarine warfare (ASW). An example of this can be seen in the Falklands War where the Argentine submarine *San Luis* managed to penetrate British ASW defenses three times. Fortunately for the British, all three attacks failed. Nevertheless, the British were forced to expend over 200 ASW weapons without result.[4] The *San Luis* also caused the Royal Navy to dedicate numerous ships and aircraft to ASW, and operate the fleet far from the position that would have optimized its capabilities.

Today, there are over 600 submarines in the world spread over 44 countries.[5] This number is decreasing, but the reduction is due to the retirement of obsolete diesel submarines and their replacement by newer, more capable units. Twenty-five modern, conventional diesel submarines are currently under construction.[6] Some of these incorporate the newest technology, including air-independent propulsion (AIP) systems that reduce or eliminate the need to surface and charge batteries.[7]

Moreover, nuclear submarine programs are currently underway in India, Brazil, and China, in addition to those

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Times, 23 January 1997.

[4] Michael D. Wallace and Charles A. Meconis, "Submarine Proliferation and Regional Conflict," *Journal of Peace Research* (vol. 32, no. 1, 1995): 82.

[5] George F. Will, "Wonders of the Deep: The Principal Threat to the U.S. Submarine Force is a Non Sequitur," *Newsweek* 4 September 1995, 68.

[6] *French Caldwell, "Submarine Warfare (Domestic & Otherwise)," Armed Forces Journal* (July 1995): 32.

[7] Antony Preston, "The Submarine Threat to Asian Navies," *Asian Defence Journal* (October 1995): 19.

in the U.S., Britain, France, and Russia. The Russian Navy is also deploying *Akula* and improved *Victor III* class submarines that are quieter at some speeds than the *Los Angeles* (SSN-688) class. Their new (*Severodvinsk* class) submarine will incorporate stealth technology that will make it quieter than the improved *Los Angeles* class.[8] Thus, by the year 2000, 12 Russian submarines will be quieter than their U.S. counterparts.[9] China is also emerging as a naval power with the third largest submarine force in the world including 5 *Han* class nuclear attack submarines and one ballistic missile submarine.[10] In addition, Iran is only one of a number of countries buying high quality *Kilo* class diesels from Russia. The *Kilo's* attack and mine laying capabilities make it capable of closing the Straits of Hormuz. Germany and France are also selling their best diesels to anyone who can afford them. Consequently, the proliferation of quiet diesel submarines will give small nations enormous leverage in strategic areas like the Strait of Gibraltar, the Indonesian Archipelago, and the Straits of Malacca.

Submarines have been, and continue to be, one of the most effective tools in our nation's arsenal. Their stealth and myriad capabilities make them a force multiplier not

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8 *AFJ*, July 1995, 32.

9 *Newsweek*, 68.

10 *ADJ*, October 1995, 19.

only because of their usefulness, but also because of the extraordinary cost other countries are required to spend countering them.

The history of submarine warfare in the United States is one of success. U.S. submarines have always adapted to the requirements placed on them. Highly mobile and able to patrol over three fifths of the planet, these submarines were critical in winning both World Wars and the Cold War. Along with the aircraft carrier, they share the roles of overseas presence and power projection earlier dominated by the battleship. U.S. submarines are "Capital Ships," and when present, they control the sea.[11]

In an era where the U.S. focus is shifting to the littoral, an effort must be made to determine a place in the defense structure for an ambitious submarine program. Is Washington spending too much on submarines at the expense of other ships with a role in littoral warfare? In order to find out, this paper will examine the history of submarine warfare, and how the Navy has adjusted to the post-war period of this century. This paper will also examine the submarine service today, and its efforts to remain a viable tool in the U.S. arsenal. Finally, it will discuss the future, and whether the Navy should continue to support a

[11] *Newsweek*, 68.

submarine program or spend its money on other weapon systems.

CHAPTER 2

HISTORY

Any discussion of submarine warfare requires an examination of its history. American experiments in underwater warfare can be traced to the days prior to the Revolution. From that time on, leaps in technology during and after America's wars led to the development of newer, more powerful submarines. The "Father of American Submarine Warfare" is, David Bushnell.[1] While at Yale, he experimented with underwater explosions and developed the submarine as a delivery vehicle for explosives. His plans were completed just in time for the American Revolution.

Bushnell's machine, the *Turtle*, had a propulsion system that became the first ship's propeller, and a detachable auger device that attached a mine to the hull of the target ship. His conning tower, which allowed the pilot to see where he was going, became the "sail" on a modern submarine.[2] Once completed the *Turtle* made four unsuccessful attempts on British warships, before Bushnell abandoned the project.[3]

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[1] Alex Roland, *Underwater Warfare in the Age of Sail* (Bloomington: Indiana UP, 1978), 70.

[2] Edwin P. Hoyt, *Submarines at War: The History of the American Silent Service* (New York: Stein and Day, 1983), 6.

[3] Roland, 81.

Another prominent figure in the history of submarine warfare is Robert Fulton. Best known for his work on steamships, Fulton also provided valuable advances in underwater vessels. Fulton's first attempts in France resulted in a "Mechanical Nautilus." But the *Nautilus,* launched in 1800, never sank a British ship. Fulton then returned to the U.S. in 1806, where he began demonstrating underwater machines, but died in 1816, never having won fame as a submarine inventor.

Throughout the War of 1812, Americans attempted to sink British ships using weapons based on the ideas of Bushnell Fulton. Although none were successful, underwater weapons were beginning to make their mark on the conduct of naval warfare. In the years between 1815 and the Civil War, American inventors continued to develop submarines. In 1851, Lodner D. Phillips, had some success with a submarine on Lake Michigan; however, after several excursions, he and his family perished when his invention sunk.[4]

The Civil War forced American engineers to choose sides. Many chose the South and used their inventions to counter Union blockades. One inventor proposed cigar shaped, steam powered spar torpedo boats (torpedo rams) designed to run almost awash. The Confederates called these

[4] Hoyt, 9.

"Davids," an allusion to David's victory over Goliath.[5] These craft, however, were not truly submersible and often had a dangerous history.[6] The first attack by a "David," occurred in 1863 against the Union ship *New Ironsides.* The torpedo explosion barely damaged the *New Ironsides,* but the David, was forced out of action.

The limited success of the David encouraged Confederate Captain Horace Hunley to design the *Hunley* which was 60' long and propelled by eight men working a long crank that turned a propeller. After numerous attempts, the *Hunley* sunk the Union corvette *Housatonic* in 1864. Unfortunately for the *Hunley's* crew, the suction created by the sinking ship pulled her underwater; all aboard were drowned.[7] This was the last submarine attack of the war.

The Union also experimented with "semi-submersibles," but with no great success. One, the *Keokuk* was used to attack Fort Sumter but was peppered with shells and sunk, ending Northern attempts at submarine warfare.[8] By the end of the War, the South's underwater warfare program claimed 43 Union vessels (29 sunk). Undersea warfare had gained

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5 Hoyt, 10.

6 Roland, 161. Lee's "David" was 50 feet long, 9 feet in diameter and powered by a steam engine that propelled her along the surface at seven knots.

7 Hoyt, 13.

8 Hoyt, 14. *Keokuk* was a cigar shaped monitor 160 ft long and 36 ft wide, with a crew of 100. She could be submerged just awash using ballast tanks.

official recognition in the Confederate Navy's Torpedo Bureau and Naval Submarine Battery service.[9]

After the Civil War, inventors all over the world attempted to build submarines. Toward the end of the century, two American inventors, John Holland and Simon Lake, began building submarines. Holland's efforts secured backing for his Electric Boat company which sold the U.S. Navy a submarine in 1900. The *Holland* (SS-1), was the first submarine commissioned by the U.S. Navy. The Navy also bought 5 more, which became A-class submarines.[10]

Meanwhile, Lake was selling submarines to governments overseas. Ironically, his designs were used by the Krupp company under Admiral von Turpitz' direction to build the German U-Boat fleet. Tirpitz was the first to envision the submarine as an offensive weapon and not as a blockade runner or coastal patrol vessel. World War I proved his ideas sound. The Unterseebote's (U-Boats), gave Germany an almost insurmountable advantage over Allied shipping.

Holland also sold submarines to other nations. In 1904, he sold the *Fulton* to the Russians who used it in the Russo-Japanese War. The next year, he sold 5 more submarines to the Japanese. The United States also bought its first 5 classes of submarines from Holland's Company.

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[9] Roland, 162.

[10] Edward L. Beach, "Admiral Charles Andrews Lockwood, Jr.," in *Men in War*, ed. Stephen Holwarth (New York: St. Martin's Press, 1992), 406.

The first, the A-class, were called "pigboats." One of the earliest pigboat captains, was Charles A. Lockwood, who was made Commander Submarine Forces Pacific fleet during World War II. Another pigboat captain was Chester Nimitz.

The first Lake-designed submarine was the G-1 class *Seal*. Although gasoline powered, the *Seal* could make 14 kts on the surface and had a record dive of 250'. Prior to World War I, U.S. submarines continued to improve. Holland's L-class were the first to look more like submarines than submergible surface vessels. They were nearly 170' long with sleek lines, a low conning tower, retractable periscopes, and a 3" gun. Holland's M-class was the first submarine to utilize a pressure hull.

Although American submarines were deployed around the world, their utility was still questioned. Fortunately, arguments in favor of the submarine won out. One proponent, Admiral Dewey, said, "Had there been a single submarine in the Spanish fleet, I could not have risked the Battle of Manila Bay."[11]

At the outbreak of World War I, the U.S. had 34 submarines, the fourth largest submarine force in the world.[12] However, the U.S. lagged behind the Germans in numbers and technology. The Germans made an early decision

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[11] Beach, 409.

to create "Blue Water" subs whereas the U.S. Navy concerned itself with coastal defense and harbor duties. However, World War I forced an adjustment in this thinking. German U-Boat success against Allied shipping spurred the Navy to ask Congress for newer, better submarines and Congress obliged.

Prior to the war, training in submarines was "on the job." Those chosen for the service were selected by luck of the draw. That changed in 1917, when training was formalized at the U.S. Navy Submarine School at New London, Connecticut. The Submarine Service was finally recognized as an accepted specialty. After Congress declared war on Germany, the decision was made to send U.S. submarines across the Atlantic into the war zone. Some were eventually sent, but World War I ended without any action by American submarines.

The U.S. submarine fleet continued on the path to excellence throughout the war. R-class boats, built at the end of the war, were "modern" submarines. They were 186' long and could travel at 13.5 kts on the surface and 10.5 kts underwater. In addition, they had diesel engines, four torpedo tubes, and a 3" gun. Finally, U.S. submarine speeds were nearing those of their surface brethren. As a

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[12] Allan R. Millett and Peter Maslowski, *For the Common Defense: A Military History of the United States of America* (New York: Free Press, 1984), 308.

stipulation of the Treaty of Versailles, the U.S. took possession of 6 captured U-Boats which were carefully photographed, diagnosed, and studied. Much of the German technology was transferred to U.S. submarines, although some of it, like the periscope, could not be duplicated until the late 1930's.[13]

After the Washington Naval Conferences (1921-1922, 1930, and 1936), efforts were made to ban submarines. The U.S. initially agreed to the ban, but changed its mind after witnessing Japanese submarine production.[14] In response to the limits placed on capital ships and forward bases agreed to at the conferences, larger submarines, capable of operating in vast areas of the Pacific, were developed.

The first of these submarines was the V-class, built in the 1920's. It was 341' long and displaced over 2,000 tons. This class carried improved periscopes and SONAR. This same period saw the Navy developing the torpedoes and exploders they would use during World War II: the Mark XIV torpedo powered by compressed air and the Mark VI combination exploder. The Mark XIV had two exploders, one magnetic and one contact. The magnetic exploder was a variation of a German design. But neither exploder was thoroughly tested because of the expense. In fact, American submarine

[13] Hoyt, 67.

skippers never even knew about them, let alone practiced with them. This lack of testing came to haunt the U.S. Navy during the early stages of World War II.

During the late 1930's, the fleet submarines that would fight in World War II were developed. The *Tambor* class was 310' long, displaced 1,500 tons and had six torpedo tubes forward and four aft. It carried 24 torpedoes on patrol, had a much better periscope, and could make 20 kts on the surface. She also carried a 5" gun, better radios, and a new torpedo data computer (TDC).

After the torpedoing of the U.S. destroyer *Kearny* and the sinking of the *Reuben James* in 1940, America became an undeclared belligerent in the war with Germany. U.S. submarines began patrols to protect shipping coming and going from American ports to Europe. But eventually all U.S. submarines were moved from the Atlantic to the Pacific where they were more needed. While in the Atlantic theater, they did not sink a single Axis vessel. On the other hand, U.S. submarines were much more productive in the Pacific. The outbreak of war in the Pacific saw the submarine fleet under manned, under equipped, and using virtually untested torpedoes and tactics. But while the tactical skill of

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[14] Michael D. Wallace and Charles A. Meconis, "Submarine Proliferation and Regional Conflict," *Journal of Peace Research* (vol. 32, no. 1, 1995): 89.

submarine skippers and crews rapidly improved, the torpedoes did not.

The Mark XIV torpedo and Mark VI exploders, used from 1941 through 1943, were repeatedly blamed by submarine skippers for the misses their boats had sustained. Statistics later showed that during this period, it took 10 torpedoes to sink one enemy ship, and in 700 patrols only 515 Japanese ships were sunk. On the other hand, the U.S. lost 22 submarines and 19 crews.[15] Navy headquarters at first refused to believe the skippers and blamed poor tactics and leadership for this substandard performance. Thus, many promising skippers were relieved during this period for poor performance.

Only Rear Admiral Charles Lockwood, one of the Navy's first submariners who had risen to COMSUBPAC, believed his skippers. He challenged Navy Department officials to improve the torpedoes. When the Navy did not act fast enough to suit him, Lockwood began testing torpedoes himself at Pearl Harbor. When he passed his results to the Navy, verifying his skippers complaints, they were discounted as unscientific. Lockwood then went to his boss, Admiral Nimitz, and explained the situation. Nimitz agreed with Lockwood's findings and authorized him to modify the torpedoes. Lockwood's dogged persistence in backing his

[15] Millett, 456.

subordinates earned him their undying respect and the nickname "Uncle Charlie".[16]

The valor of the men of the Submarine Service is too extensive to be chronicled here, but as statistics show, the silent service was the most effective branch of Naval Service in World War II. The submarine fleet of 319 boats accounted for 1,042 Japanese ships sunk, over one half of their merchant fleet and one third of their warships. For every ton of shipping Japan built, she lost three.[17] In addition to sinking ships, submarines were used for insertion and extraction of forces, evacuation of combatants and non-combatants, and supply and rescue missions (504 downed aviators). All of this was accomplished by a force that composed only 1.6% of U.S. personnel.

But the "Silent Service" paid a price for this effectiveness. Fifty-two submarines never returned from patrol and 3,505 crewmen were lost. The submarine Navy had a casualty rate of 23%, the highest of any branch of service.[18] It also accounted for an impressive amount of individual and unit awards: seven Congressional Medals of Honor; 49 Presidential Unit Citations; 52 Navy Unit Citations and myriad Navy Crosses, Silver and Bronze Stars.

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16 Beach, 406.

17 Mochitsura Hashimoto, trans., E. H. M. Colegrave, *Sunk: The Story of the Japanese Submarine Fleet, 1941-1945* (New York: Holt, 1954), 241.

18 "United States Submarine Losses," under the keyword "Maritime," downloaded from www.maritime.org/sublost.shtml, 27 December 1996.

Once the tactics, techniques, and mechanical difficulties were worked out, the Submarine Service developed into a professional, proficient, and highly effective branch of the U.S. Navy. It ended the war riding a wave of invincibility, with a belief that its efforts had decisively effected the war's outcome.

After the war, America gained access to German and Japanese records and weapons designs, and Washington learned that the enemy had been far ahead in matters relating to submarines. The Japanese torpedo was superior to any torpedo used by the U.S. Navy. It had a longer range and was more powerful, faster, and more reliable. The Japanese also incorporated a snorkel breathing device based on German technology that would allow their submariness to run their engines to recharge batteries while submerged. In this way, they truely became "submarines," not just "submersibles."[19]

Throughout the war, the Japanese focused their submarine efforts not on sinking warships, but on acting as auxiliary vessels for re-supply of their forward bases. Had they undertaken the U.S. method of targeting merchant vessels, the results of the war may have been quite different.

Lieutenant Commander Hashimoto, who was responsible for sinking the *USS Indianapolis*, stated in his book, Sunk, that

[19] Hoyt, 297.

because Japanese submarines were used as re-supply vessels without radar, and because Tokyo did not build enough of them, the outcome of the war was inevitable. Attrition in the Japanese Submarine Service was well over 50 percent. While the Japanese were willing to accept such losses, they could not make up for them. Only 12 submarines survived the war. The Japanese Imperial Navy seemed to believe that a refusal to admit defeat would ensure victory.[20]

Meanwhile, in the Atlantic, the Germans began developing faster submarines with more endurance in an attempt to answer the outstanding effectiveness of Allied ASW. This technology was integrated into German submarines just as the war ended. One class could attain 18 kts submerged and dive to 1,000' while another was designed to operate at 25 kts submerged.[21]

When the war ended, Congress cut military budgets and most submarines were put into mothballs. The post-war concept of National Defense Strategy hinged on the aircraft carrier; all other ships were re-designed and built to assist the carrier. One program started after the war was the "Guppy Program," a conversion project designed to implement German technology. The first of these conversions, the *Guppy I*, attained 18.2 kts submerged, 0.4

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[20] Hashimoto, 124.

[21] Gary E. Weir, *Forged in War* (Washington: Naval Historical Center, 1993), 77. For more on German improvements by class, see Forged in War.

kts faster than its surface speed. The *Guppy II* performed similarly with a snorkel installed. Subsequently, 24 fleet submarines were converted to *Guppy II* design, as others were converted to oilers, troop carriers, cargo transports, and radar picket ships.[22]

Another step in the Navy's plan to maintain post war dominance, was the development of more advanced SONAR. As SONAR technology improved, fleet submarines were equipped with it. Nevertheless, the outbreak of the Korean War in 1950 found the Navy's submarine fleet as unprepared as the other services. Most submarine activity centered on landing agents, intelligence, and reconnaissance. The only difference between submarines used in World War II and Korea, was the snorkel device. In the early 1950's, the Navy began work on a new submarine called the *Albacore* (AGSS-569). The *Albacore* was developed as a test bed for high speed submerged research. The *Albacore* was launched in 1953 with sound reduction, a hull to test new single screw propulsion, control surfaces, and hull coatings to reduce frictional resistance. After a year of testing, the *Albacore* was used as a basis for the Navy's next combat submarine, the *Barbel* class.

As the Navy developed faster, quieter, and longer range diesel-electric submarines, a concurrent effort was afoot to

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[22] Weir, 109.

develop a nuclear powered submarine. The idea that nuclear power "would enormously increase the range and military effectiveness of a submarine" was first proposed by Dr. Ross Gunn, at the Naval Research Laboratory (NRL) in 1939.[23] NRL's efforts placed the Navy at the forefront of nuclear research. While development of the A-bomb delayed research on a nuclear power propulsion system, the Navy maintained an interest in it throughout the war. After the war, the Navy worked closely with the Atomic Energy Commission to develop a nuclear powered reactor.[24]

The Navy, working in conjunction with Westinghouse and General Dynamics, developed a submarine thermal reactor (STR) using pressurized water as its heat transfer medium. The *Nautilus* (SS-571), married to the STR, was destined to be the world's first nuclear powered warship; its maiden voyage occurred in January 1955.

Just six months after the launch of the *Nautilus*, the *Seawolf* (SS-575), was launched. The *Seawolf* had been concurrently developed and would become the test bed for a General Electric-produced sodium-potassium cooled submarine intermediate reactor (SIR). This reactor used liquid metal as a coolant and heat transfer medium. But, shortly after its initial voyage, the Navy was forced to retrofit the

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[23] Weir, 155.

[24] Weir, 160.

Seawolf with STR powerplants.[25] Lessons learned on the *Nautilus*, *Seawolf*, and *Albacore* translated into the quieter, more powerful submarines of the future.

In order to answer the threat of the growing Soviet fleet, the Navy began building submarines that were fast, maneuverable, and quiet. These newer models were deep diving and carried long range SONAR. Other nuclear submarines such as the *Skate* class were also developed during this period. The *Skates* were designed for ASW and Arctic operations and were one of the last classes built for so narrow a purpose.

The Navy also began experimenting with submarine launched rockets. Like many technologies developed after World War II, modern American submarines armed with guided or ballistic missiles found their ancestry in the German Navy. During the post-war years, the U.S. borrowed liberally from this technology and used it to develop its own missiles.

The *Loon*, developed in the late 1940's was the first U.S. attempt to launch a guided missile from a submarine. It was guided by a radio command link on the submarine.[26] The next attempt was the *Regulus I* missile that cruised at 0.95 Mach, had a 3,000 pound warhead, and flew up to 500

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[25] Weir, 186.
[26] Weir, 231.

nautical miles, controlled from ship to ship.[27] The success of the *Regulus I* led to the development of *Regulus II*. This missile could attain Mach 2 with a range of 1,000 nautical miles. Its success precipitated the development of the *Grayback* and *Growler* (SSGs) which had to be designed specifically for the *Regulus* missile. During construction, the Navy decided to marry a nuclear submarine to these new ballistic missiles. This led to the development of the *Halibut* (SSGN-587).

The development of the *Polaris* missile and cancellation of the *Regulus II,* forced the Navy to build the *George Washington* (SSBN-598) to launch the *Polaris*. The conversion of the *Skipjack* class nuclear attack submarine *Scorpion* (SSN-598), to the *George Washington*, required the addition of a 141' segment of hull containing 16 *Polaris* missile tubes.

The launch of *Sputnik* by the Soviets in October 1957, forced the Navy to speed production of the *Polaris*. The *George Washington* launched its first *Polaris* missile in July 1960, a full five years earlier than originally planned. The *Polaris* missile paired with the SSBN, placed the U.S. Navy in the forefront of submarine warfare and made the George Washinton one of the two most important warships in the world. The submarine's new roll in Naval power

[27] Weir, 234.

projection assured its place in the National Security budget for the next 30 years. Only the end of the Cold War would terminate this dominance.

CHAPTER 3

CURRENT AND FUTURE ROLES AND MISSIONS

The U.S. Navy's "Silent Service" is currently engaged in fierce competition with the surface and air arm of the Navy for new, littoral roles. As the more traditional roles of power projection, sea control, and strategic deterrence become less important after the Cold War, submarines are looking to the littorals for new mission requirements. With the publication of ...From the Sea in 1992, the Navy made a landmark shift in direction as a result of the changing strategic landscape. The global maritime threat was diminished. The Navy's new direction would be one of projecting power and influence.[1]

Additional guidance in this shift, was published in the National Military Strategy (1995) and the President's National Security Strategy of Engagement and Enlargement (1996). The review of strategy and force requirements detailed in these documents resulted in a shift in the Department of Defense's (DODs) focus to new dangers. The greatest danger identified being aggression by regional powers. In order to combat this new threat, emphasis was placed on maintaining forward-deployed naval forces and the

[1] U.S. Department of the Navy, "Forward...From The Sea," (Washington, DC: GPO, 1995), 1.

necessity to rapidly project "decisive military power to protect vital U.S. interests and defend friends and allies." At the same time, the more traditional roles of strategic deterrence, sea control, maritime supremacy, and strategic sealift must also be maintained.[2]

The Navy's response to DOD's new focus is laid out in Forward...From the Sea. Taking its direction from this document, the Submarine Service began to re-assess its own mission. As a result, it determined that in addition to maintaining the capability to conduct strategic deterrence and sea control, it would focus on littoral regions. The littoral zone mission requirements that must be trained to are: land attack, anti-submarine and anti-surface warfare, special forces insertion and extraction, mine laying, and intelligence gathering.[3]

These missions are not new to the Submarine Service. In fact, during World War II, Korea, and Vietnam submarines were used extensively for special forces insertions and extractions, mine laying, intelligence gathering and occasionally, land attack. Unfortunately, the capability to conduct these missions was minimized and even lost when the last U.S. diesel submarines were retired.

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[2] FFTS, 1.

[3] LCDR James E. Wright, USN (Ret.), "Submarine Designs for the Littorals," *Proceedings* (December 1995): 39. The littoral region is roughly defined as the land within 50 miles of the high-water line and the sea within 100 miles of the high-water line.

Competition with the surface and air component for scarce defense dollars is forcing the Submarine Service to re-learn these missions and become the platform of choice to conduct them. Its efforts to do this are well documented, and it would be worthwhile to explore the successes and failures.

INSERTION AND EXTRACTION

The Navy currently has 8 submarines adapted to conduct special warfare missions; however, all of these are scheduled to be de-commissioned by 1998. Plans call for converting a total of 6 *Los Angeles* class SSN's (3 on each coast) to fill this role. Two of these 8 submarines are converted SSBN-640 class boats: the *Kamehameha* (SSN-642) and the *James K. Polk* (SSN-645). These submarines are designed with dual dry-deck shelters (DDS) enabling them to carry one or two SEAL delivery vehicles (SDV) or 8 combat rubber raiding craft (CRRC) in addition to 50-70 Naval Special Warfare personnel, and (if required) 100 Army or Marine Corps special operations personnel.[4] The other 6 submarines dedicated to this role are SSNs and have the capability to carry only one DDS, limiting their effectiveness. In addition to the 6 SSNs assigned to this mission, a third

submarine in the *Seawolf* class will be built with its torpedo magazine modified to carry 50 commandos.

Recent training on the *Kamehameha* by U.S. Marines revalidates the utility of these special warfare platforms. With no doctrinal publications available and previous Marine Corps experience in this arena, the lessons learned were numerous.[5] A company of Marines from 1st Battalion, 3d Marines embarked and conducted two and one-half days of pier side rehearsals. Procedures had to be developed for stowing the CRRCs, motors, and other gear in the two converted ballistic missile tubes prior to putting to sea.

A number of problems were encountered during this practice period, but as a proof of concept, this exercise proved the validity of using submarines in this role. The problems discovered during the exercise are easily remedied and with continued refinement, the ability to launch a raiding force from a sub-surface platform could provide an excellent operational advantage to a Joint Task Force Commander.[6]

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[4] CDR Michael P. Wood, USN, "Tridents Fill Special Warfare-Strike Requirements," *Proceedings* (December 1996): 73.

[5] Lt Col Reynolds B. Peele, USMC, Capt Peter Petronzio, USMC, and Capt George W. Smith, Jr., USMC, "Combat Power Projection 'Forward...From (Under) The Sea,'" *Marine Corps Gazette* (June 1995): 12.

[6] *Gazette*, June 1995, 15.

After the turn of the century, another insertion and extraction device, the ASDS, will be fielded. The ASDS is a dry mini-submarine, 55' long with a two man crew. It is

capable of carrying a SEAL squad of 8 men on long range clandestine insertion and extraction missions. The ASDS is designed to operate from either a submersed submarine or the well deck of amphibious ships, and it is funded by the U.S. Special Operations Command.[7]

LAND ATTACK

During the Cold War, practice torpedo attacks on Caribbean and Pacific ranges were conducted thousands of times by U.S. attack submarines. The undersea battle they were preparing for never came, and no warshots were ever fired by U.S. submarines. In more recent battles, U.S. submarines have fired warshots at the enemy. However, these warshots were not torpedoes, but rather *Tomahawk* land attack cruise missiles: 12 during the Gulf War and several more in response to aggressive acts by Saddam Hussain after the Gulf War.[8] Unfortunately for the U.S. Submarine Service, this new role puts it in direct competition with the surface and air Navy, both of which claim the land attack strike mission.[9]

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[7] Scott C. Truver, "Tomorrow's Fleet: Part II," *Proceedings* (July 1995): 93.

[8] George F. Will, "Wonders in the Deep: The Principal Threat to the U.S. Submarine Force is a Non Sequitur," *Newsweek* 4 September 1995, 68.

[9] French Caldwell, "Submarine Warfare (Domestic & Otherwise)," *Armed Forces Journal* (July 1995): 32.

Efforts are also underway to adapt the Army's Tactical Missile System (ATACMS) to the submarine. Like the *Tomahawk*, the ATACMSs will be fired from the submarine's vertical launch system. This adaptation would allow submarines to fire non-nuclear ballistic missiles. ATACMSs travel at nearly six times the speed of the *Tomahawk*, whose relatively low speed makes it vulnerable to air defenses.

Submarine proponents also argue that the stealth characteristics of U.S. attack submarines make them the ideal platform in areas where land-based cruise missiles can threaten surface ships, and air defenses can make aircraft vulnerable. In fact, a recent study by the Naval Research Advisor Committee revealed that the greatest weakness in the Navy's littoral warfare strategy is the lack of defense against antiship cruise missiles.[10] This point argues in favor of using submarines in a littoral role.[11]

MINE WARFARE

A recent example of the effectiveness of mines can be found in the Gulf War where Iraqi ground mines prevented an amphibious assault in Kuwait. They also had a major impact on the ability of U.S. battleships to provide Naval gunfire support. Two warships were damaged by mines during the war, the *Princeton* (CG-59) and the *Tripoli* (LPH-10). The mines

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[10] Joseph N. Giaquinto, "The Quick Strike Submarine," *Proceedings* (June 1995): 42.

[11] *AFJ*, July 1995, 32.

that inflicted this damage probably cost Baghdad only a fraction of the cost of repairing the two ships. That is what makes mines so attractive to other third world navies.[12] Mines have been called "the poor man's navy" because of their cost, effectiveness, and ease of use.

Today's mines can search for targets and distinguish between them. They can also distinguish between warships, merchant vessels, and submarines. In fact, the best method for employing mines is the submarine.

As the U.S. Navy re-directs its efforts toward the littorals, the ability to lay and detect mines has become one of the submarine's greatest assets. It is also a mission that translates easily to the littoral focus. Relying on their inherent stealth capabilities, submarines, unlike surface warships or aircraft, can covertly lay mines in sea lanes, choke points, ports, and harbors without exposing themselves to risk.[13] As Ensign Jim Crimmins, USN, says in his Capstone essay, "Mine Warfare and Submarines,": "Mines are 24-hour sentries that don't sleep, eat, and with today's technology, usually don't miss an intruder."[14] With current technology, U.S. submarines can lay mines in a harbor from 4 nautical miles away.

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[12] ENS Jim Crimmins, USN, "Mine Warfare and Submarines," *Proceedings* (October 1994): 81.

[13] Michael D. Wallace and Charles A. Meconis, "Submarine Proliferation and Regional Conflict," *Journal of Peace Research* (vol. 32, no. 1, 1995): 84.

Unfortunately, this capability is degrading. One of the mines U.S. submarines carry, the MK-67 Submarine Launched Mobile Mine (SLMM), is becoming obsolete while the other, the deep-water antisubmarine mine, MK-60 *Captor*, has little applicability in littoral warfare. At the same time, however, The Navy is developing a detection/classification sensor for a future littoral sea mine and a program to incorporate lithium batteries into mine systems.[15]

While mines are one of the submarine's best weapons, they are also one of its biggest threats. Unlike other ASW threats (aircraft and submarines), mines make no noise as they wait for their prey. Until the mine problem is properly addressed and new anti-mine warfare systems are fielded, any activity in the Navy's shallow water future will limit both its submarine and surface ship activities.

Today's submarines have little defense against mines. The Navy recognizes this, and as submarines move into the littorals, it is developing countermeasures. One of these is advanced SONAR which is one of the most efficient methods of detecting mines. For example, the *Seawolf* is equipped with synthetic-aperture and ultrawide-band SONAR. These SONARs are designed to generate high resolution images of

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[14] *Proceedings*, October 1994, 80.

[15] *Proceedings*, July 1995, 93.

the sea and the seabed, and can "paint" any mines they encounter allowing the submarine to destroy or go around them.

The GCE-Marconi *Archerfish* system is another countermeasure being developed. The *Archerfish* is a wire guided, self-propelled disposal weapon that will be used to destroy moored and ground mines. The third submarine countermeasure is a laser-based sensor which is designed to provide high-resolution, high-contrast images for route survey.[16] The Navy has already fielded one of these systems for testing on the *Dolphin* (AGSS-555). Still another mine countermeasure is the unmanned, underwater vehicle slated to be equipped with the near-term mine reconnaissance system (NMRS), designed to operate from submerged submarines.[17]

Today's submarines are the ideal platform for delivering and detecting mines in the littoral region. Unfortunately, they are also susceptible to that same threat. Only by continued development of mine counter-measures, like those of the *Seawolf*, will the Navy be able to exploit the advantages submarines provide us in the littorals.

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16 *Proceedings*, October 1994, 80.

17 *Proceedings*, July 1995, 93.

INTELLIGENCE GATHERING

Submarines have been used for years to gather intelligence. Their stealth characteristics make them an ideal choice to "spy" on enemies. However, most of the information which the submarine is capable of collecting (electronic, photographic, HUMINT, and sensor intelligence) is classified. Needless to say, these extensive capabilities continue to improve. In addition to on-board sensors, efforts are underway to extend the range of UAVs by linking them to submarines. The UAV would be launched from a surface ship far off shore and be handed off to the submarine via data link.[18] The submarine would then use its stealth capability to stand inshore and control the UAV through its periscope, thereby extending the range of control. This extended range could help give the National Command Authority (NCA) near real-time data without risking the life of a pilot.

These examples of current Submarine Service operations, while incomplete, illustrate the myriad efforts expended to define the submarine's role in the post Cold War environment. A real fight is being waged to garner the Submarine Service a portion of the dwindling defense dollar. Submariners, like aviators and ship drivers, believe that

they are still important to the defense of our nation. Acquisition efforts now underway will determine not only how the U.S. will be defended, but also the method and viability of that defense.

[18] Frank Oliveri, "Navy to Try Steering UAVs from Undersea," *Navy Times* 11 September 1995, 30.

CHAPTER 4

CONCLUSIONS

The United States is a maritime nation, and as such must rely upon the sea for trade. In order to do so, it must ensure that its Sea Lines of Communications (SLOCs) remain open by retaining preeminence on the oceans of the world. The only way to do this is to retain the capabilities that currently reside in the U.S. Navy; submarines, aircraft carriers, amphibious ships, maritime prepositioning ships, air defense, and anti-submarine warfare ships. All of these are important and a proper mix which fits the defense budget must be implemented. Having said that, it has been determined by DOD, with the advice and consent of Congress, that current procurement will meet U.S. needs. The future, however, is a different story. DOD's percentage of the budget could continue to shrink, and the time might come when the Navy will look back on its 350 ship force with envy.

Naval planners, working to stay within this shrinking budget, started reducing the type and number of ships purchased while mothballing others. A prime example of this phenomenon is the *Seawolf* program. Production of the *Seawolf* went from 29 ships down to 1, while Congressional gerrymandering increased this number to 3. On the

amphibious side, Navy planners argued that 12 Amphibious Ready Groups (a total of 36 ships) would be required to fulfill strategic obligations. They saw the need to provide amphibious lift for a 2.5 Marine Expeditionary Brigade (MEB) equivalents. Congress agreed, and in order to reach that goal, the Navy is building a total of 7 LHD-7s and 12 LPD-17s. LPD-17s are ships whose capabilities allow them to replace a total of 41 ships: 20 LSTs, 11 LPDs, 5 LKAs, and 5 LSDs. The number of aircraft carriers is programmed to remain stable at 12.

Granted that a planned mix of ships meets our short-term strategic goal, the question then becomes what will be done if budgets shrink even further? The Submarine Service's answer is the *Centurion* (NSSN) class. While retaining most of the capabilities of the *Seawolf* and improving others, each NSSN, utilizing modular construction and state-of-the-art computer techniques, will cost between one-third to one-half less. The cancellation of the *Seawolf*, and the subsequent production of the NSSN, allows the Navy to maintain and even expand its industrial base while giving Washington time to rethink its strategic priorities.

The *Seawolf*, designed as a replacement to the *Los Angeles* class attack submarine, was created to maintain the U.S. technological lead in the Cold War while countering

Soviet improvements in submarines and ASW.[1] However, the end of the Cold War and the fall of the Soviet Union reshaped U.S. priorities. The Navy's focus shifted to the littoral regions while at the same time retaining the capability to counter improved Soviet submarines.

The *Seawolf* is capable of carrying out non-traditional missions such as land attack, mine laying, insertion and extraction, and intelligence gathering. It was designed to carry twice the number of *Tomahawk* cruise missiles and torpedoes that existing U.S. attack submarines carry, and its SONAR has an improved mine hunting capability.[2] When asked if he would have any problem operating in the littoral environment, *Seawolf* PCO, Cmdr. David McCall said, "I wouldn't have any problem with 20 feet of water under my keel."[3] While this statement may have been an exaggeration, it does point out the fact that submariners are willing to shift their thinking and accept new missions. However, at 1.2 billion dollars a platform, cost may be the determining factor as to whether or not the *Seawolf* will be used in this role.

The NSSN is being designed from the ground up to operate in the shallow waters of the littoral. Captain Dan

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1 The *Seawolf's* ASW mission effectiveness is three times that of the improved *Los Angeles* class.

2 *Proceedings*, June 1992, 56.

3 John G. Roos, "New and Newer Submarines," *Armed Forces Journal*, (July 1995): 16.

Burgess, who was in charge of the Navy's New Attack Submarine Program (NSSN), confirmed this, when he pointed out that nuclear submarines have always taken on missions besides ASW and ASUW for which they are best known. "We've always done these other missions, but the NSSN is the first submarine that has littoral warfare missions designed from the beginning."[4]

Unfortunately, while less costly than the *Seawolf*, the NSSN is still too expensive. The Navy needs to develop a mix of submarines. This mix should include nuclear as well as smaller, cheaper, diesel submarines that incorporate all the technology of the *Seawolf* and NSSN (SONAR, communication, land and ship attack capabilities) while taking advantage of the cost benefits and quietness of diesel and AIP systems. The AIP system increases submerged endurance by up to five times at slow speed. These less costly, quiet submarines should also incorporate modular construction and computer design like the NSSN. LCDR James E. Wright makes the argument for modular construction in his paper "Submarine Design for the Littoral,"

> Already proved in the construction of the Netherlands *Walrus* and the Australian *Collins* classes, modular submarine ship-building would provide the flexibility for multiple hull configurations to accommodate different mission requirements. Separate propulsion system modules would allow for nuclear, diesel, or air independent propulsion (AIP) systems, to reduce

[4] *AFJ*, July 1995, 32.

> construction and life-cycle costs. Separate weapon modules could be provided for different missions, including special forces insertion [and] extraction, mine laying, missiles for land attack or antishipping.[5]

Modern diesel submarines, while not as capable in blue water, are excellent weapons in the littoral. Professionally operated diesels pose a legitimate threat to Naval forces operating in the littorals. Unlike minefields, submarines can lay in wait or seek out the enemy. Even the poorly operated Argentine diesel submarine *San Luis* threatened the Royal Navy in the Falklands. This type effect, makes the submarine (especially diesels) an attractive, relatively low-cost addition to any Navy, large or small.

By producing both diesel (with AIP) and nuclear submarines, the U.S. could more effectivly spread its submarine force according to capability in the littoral and blue water environments. This is exactly what countries which operate both types of submarines do.[6] A $200-400,000 dollar diesel submarine is more expendable than an $800,000 dollar NSSN.

While the U.S. Navy's focus on weapon system production has shifted to the littoral, the capability to conduct blue

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[5] LCDR James E. Wright, USN (Ret.), "Submarine Design for the Littorals," *Proceedings* (December 1995): 39.

[6] Stephen L. Ryan, "Shallow Threats: Has the Shallow Water Submarine Threat to Blue Ocean Navies Been Overrated?" *Asian Defense Journal* (July 1995): 17.

water operations must be retained. AIP technology gives the modern diesel submarines of small nations an increased submerged endurance that allows them to operate far out at sea. In addition, the Russian threat, while less serious than before, still exists. The U.S. Office of Naval Intelligence (ONI) states that Russia has 48 SSBNs, 22 nuclear powered cruise missiles, and 65 diesel powered submarines for a total of 135. The U.S. currently has a total of 101 nuclear powered submarines and no diesels. Add to this the fact that Russia still has the largest, most diversified sea-mine supply in the world; Moscow is producing rocket powered torpedoes for its own use and that of its *Kilo* customers. If the START II Treaty is ratified, Russian nuclear warheads will be reduced to between 3,000 and 3,500. More than half of these will be deployed on SSBNs.[7]

China's submarine fleet is also growing. In addition to the 6 nuclear powered submarines China currently possesses, the Chinese Navy has begun building a number of modern diesel submarines. China's fleet used to have a home water mission. But evidence now suggests that the Chinese Navy is testing its capability to go into deep water. A *Han*

[7] Arnold Beichman, "The Power of Russia's Navy," *Washington Times*, 7 March 1997.

class nuclear attack submarine was sighted by the *Kitty Hawk* in the Yellow sea in 1994.[8]

As far as the U.S. Navy's SSBNs are concerned, Congress is mandating that current levels be maintained until START II is ratified by the Russians. Recently, however, U.S. State Department officials have offered SSBN reductions in return for Russian ratification of START II and Moscow's approval of limited NATO expansion.[9]

But even if the U.S. Navy minimizes the Russain and Chinese threats, other super power threats could arise. It took Japan less than 50 years to go from a closed, backward nation to a Naval power capable of defeating Russia, one of the great European powers. In 1850, Germany was little more than a collection of duchies, but by 1871, it was a dominant force in Europe. In 1935, the United States was in the middle of a depression, had few armed forces to speak of, and had isolated itself from the world. By 1945, it was the most prosperous, industrially developed nation in the world.[10]

While many say that the need for the submarine diminished with the end of the Cold War, threats from

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[8] Ernest Blazer, "Is the Submarine Threat Over Yet? Nyet!" *Navy Times*, 10 July 1995.

[9] Jonathan Clayton, "U.S. to Offer Cutback in Nukes on Subs," *Washington Times*, 26 January 1997, 17.

[10] U.S. Marine Corps, "Operational Maneuver From the Sea: A Concept for the Projection of Naval Power Ashore," (Washington, DC: Marine Corps Association, June 1996), A-2.

Russia, China, and other developing countries dispel that theory. The U.S. must maintain a robust submarine capability to counter the threat posed by any combination of future sea powers. The best way to do that, in today's budget restrained military, is to simultaneously develop NSSN and diesel submarines. Remember that the best ASW weapon in the world is the submarine.

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